

EGU2020-13271

<https://doi.org/10.5194/egusphere-egu2020-13271>

EGU General Assembly 2020

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



Critical minerals in the European seas: The project GeoERA-MINDeSEA

Javier Gonzalez¹, Teresa Medialdea¹, Henrik Schiellerup², Irene Zananiri³, Pedro Ferreira⁴, Luis Somoza¹, Xavier Monteys⁵, Thomas Kuhn⁶, Johan Nyberg⁷, Igor Melnyk⁸, Vitor Magalhaes⁹, Rosario Lunar¹⁰, Egidio Marino¹⁰, James R. Hein¹¹, Georgy Cherkashov¹², and MINDeSEA team¹

¹Geological Survey of Spain (IGME), Marine Geology Division, Madrid, Spain (fj.gonzalez@igme.es)

²Geological Survey of Norway (NGU)

³Hellenic Survey of Geology and Mineral Exploration (HSGME). Greece

⁴National Laboratory of Energy and Geology (LNEG). Portugal

⁵Geological Survey Ireland (GSI)

⁶Federal Institute for Geosciences and Natural Resources (BGR). Germany

⁷Geological Survey of Sweden (SGU)

⁸SRDE "Geoinform of Ukraine" (GIU)

⁹Portuguese Institute for Sea and Atmosphere (IPMA)

¹⁰Geosciences Institute (IGEO). Spain

¹¹U.S. Geological Survey (USGS). USA

¹²Institute for Geology and Mineral Resources of the Ocean (VNIIOkeangeologia). Russia

The oceans and seas cover more than 70% of the planet, representing a promising new frontier for mineral resources exploration, and an enormous challenge for science and technology. Communities are demanding actions to address global climate change, and the necessary high- and green-technologies required for a transition from a carbon-based to green-energy-based world. The global ocean is at the core of these issues. The seabed mineral resources host the largest reserves on Earth for some critical metals like cobalt, tellurium, manganese, and the rare earth elements, critical for Industry. But seabed geology and ecosystems are widely unexplored, and new geological and environmental studies are required to address the impacts of potential mining activities. In addition, a regulatory framework for minerals extraction and marine spatial planning are necessary for seabed mining sector development.

The pan-European seas cover about 15 millions square kilometres in the Arctic and Atlantic oceans and the Mediterranean, Baltic, and Black seas, from shallow waters up to 6000 m water depth. Spanning a large diversity of environments and resource settings, including high and low temperature hydrothermal deposits, phosphorites, cobalt-rich ferromanganese crusts, and manganese nodules, deep-sea deposits are particularly attractive for their polymetallic nature with high contents of rare and critical metals. Moreover, shallow-water resources, like marine placer deposits, represent another source for many critical metals and gems. The GeoERA-MINDeSEA[1] project is compiling data and genetic models for all these deposit types based on extensive

studies, carried out previously, which include geophysical surveys, dredging stations, underwater photography and ROV surveys, and mineralogical, geochemical, and isotopic studies.

The preliminary MINDeSEA results show the potential of the pan-European seas for critical metals, and the enormous gaps of information covering vast marine sectors. More than 600 mineral occurrences are reported in the MINDeSEA database. Seamounts and banks in the Macaronesia sector (Portugal and Spain) and the Arctic ridges (Norway, Denmark, Iceland) show a high potential for Fe-Mn crusts, rich in energy-critical elements like Co but also Te, REEs, and Mn. Fe-Mn crusts are accompanied by phosphorites on the seafloor of continental shelves and slopes along the western continental margins. Seafloor polymetallic sulphides and metalliferous sediments precipitating from hot hydrothermal solutions and plumes are forming today in the Azores Islands (Portugal), the Arctic (Norway, Denmark) and, the Mediterranean volcanic arcs (Italy and Greece). They are among the most important marine resources for Cu, Zn, Ag, and Au. In addition, hydrothermal deposits may contain economic grades of Co, Sn, Ba, In, Bi, Te, Ga, and Ge. Placer deposits of chemically resistant and durable minerals have been discovered on shallow-water settings (<50 m water depth on estuaries, deltas, beaches) linked to the weathering of onshore rocks and ore deposits from the Variscan Belt (UK, France, Portugal, Spain). Finally, shallow-water concretions and nodules from the Arctic, Baltic, and Black Sea represent potential targets for metals exploration and environmental studies.

[1] This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166